Berthierite from Kisbánya, Carpathians.[1]

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THE mineral berthierite has hitherto been known from two localities in the region of the Carpathian Mountains. It was first recorded by A. Löwe[2] in 1847 from Aranyidka[3] in the Hungarian comitat Abauj-Torna, where it occurred 'massive and disseminated, columnar and fibrous, with jamesonite and stibnite'.[4] Much later, about 1908, J. Krenner[5] recognized it from Felsőbánya[6] in the Hungarian comitat Szatmár, but his paper describing it, which was read before the Hungarian Academy of Sciences on October 19, 1908, was not published until after his death. Here the mineral occurred as parallel and radiating aggregates of deeply striated grey fibres, which are often intimately intergrown with stibnite. Other associated minerals are needles of mispickel and small plates of baryte.

The third occurrence of berthierite in this region, to be now described, is at Kisbánya[7] in the Hungarian comitat Szatmár. The material was sent for determination to the Hungarian National Museum by Mr. Gyula Kupás of Nagybánya (= Baia Mare).

[1] Read before the Hungarian Academy of Sciences, Class III (Natural Sciences), on January 15, 1934.

[2] A. Löwe, Ber. Mitt. Freunden d. Naturwiss. Wien (Haidinger), 1847, vol. 1 (for 1846), pp. 62–64.

[3] Now Zlatá Ida in župa (county) Košická, Slovakia.

[4] E. von Fellenberg, Die Mineralien der ungarischen und einiger siebenbürgischen Erzlagerstätten. Gangstudien (B. von Cotta and H. Müller), 1862, vol. 4, p. 126; also in B. von Cotta and E. von Fellenberg, Die Erzlagerstätten Ungarns und Siebenbürgens. Freiberg, 1862, p. 126.

[5] J. Krenner, Berthierit Felsőbányáról. Math. és Természettud. Értesítő, 1928, vol. 45, p. 13 (Hung.), p. 14 (Germ. résumé); German also in Centr. Min., Abt. A, 1928, pp. 270–271. [Min. Abstr., vol. 4, p. 8.]

[6] Now Baia Sprie in judeţ (district) Satu Mare, Romania.

[7] Kisbánya, meaning little mine; now Chiuzbaia, judeţ Satu Mare, Romania. Another well-known mineral locality named Kisbánya (= Járabánya or Jarabánya) is in comitat Torda-Aranyos, Transylvania (now Băişoara, judeţ Turda, Romania).

Here needles of berthierite occur singly or as parallel or irregular aggregates grown on the inside of carbonate crusts; also as brushes up to 6 cm. long, with rounded surfaces and consisting of slightly divergent groups of needles growing freely in cavities in the carbonate crusts. Rosettes of stibnite on the inside of these crusts are partly covered with berthierite needles.

The needles of berthierite are dark grey or brownish with a bright metallic lustre, but the colour on a fresh fracture is always dark grey. They are striated parallel to their length, and they break very easily across this direction.

The associated carbonates are of various kinds: probably two varieties of Ca-Mg carbonate with Fe and very little Mn, one of them crystallizing as $(10\bar{1}1)$ rhombohedra; two varieties of calcite with Fe, Mn, and Mg, one as $(01\bar{1}2)$ rhombohedra; chalybite with Ca, Mg, and Mn, as $(01\bar{1}2)$ rhombohedra; and finally, a Fe-Ca carbonate with Mg and Mn. The associated stibnite contains traces of iron and forms rosettes of crystals with bright faces.

Although the presence of stibnite amongst the needles of berthierite was not evident to the unaided eye, nevertheless it was necessary to be assured that the material collected for chemical analysis and for the determination of the specific gravity was entirely free from intergrown stibnite. For this purpose the material was treated with a solution of potassium hydroxide, when only very few needles turned red, indicating the presence of but little stibnite. This was then removed by treatment with an 8·1 % solution of KHS according to the method of J. Loczka.[1]

The material used for analysis was collected from the larger brushes. The specific gravity determined on 0·2068 gram in the small pyknometer of Winkler[2] using carbon tetrachloride is d_4^{20} 4·65₂.

Qualitative tests showed the presence of antimony, iron, and sulphur as the main constituents, with a trace of manganese. For the quantitative analysis the finely powdered mineral was dried at 100° C. A quantity (0·6376 gram) was mixed with four times its weight of $KClO_3$ and dissolved in HCl (sp. gr. 1·12) in the presence of tartaric acid. The antimony was precipitated as sulphide and weighed as Sb_2O_4. Iron was precipitated from the filtrate as sulphide and weighed as Fe_2O_3 after reprecipitation with ammonia. Sulphur was

[1] J. Loczka, Zeits. Kryst. Min., 1903, vol. 37, p. 383.

[2] L. W. Winkler, Ausgewählte Untersuchungsverfahren für das chemische Laboratorium. Die chemische Analyse, vol. 29, Stuttgart, 1931, p. 8.

estimated as $BaSO_4$ in an aliquot portion of the original solution, the small amount of sulphur which separated during the solution of the mineral being added to this, giving 29·40 %. A second determination of sulphur was made on a separate portion (0·4228 gram) by fusing the mineral with Na_2CO_3 and KNO_3 in a nickel crucible according to the method of Fresenius, giving 29·52 %.

The results of this analysis are given under I. Under II are the percentages reduced to 100 % after deducting the insoluble portion, showing a close agreement with the values calculated for the formula $FeS.Sb_2S_3$.

	I.	II.	Atomic ratios.	Calculated for $FeS.Sb_2S_3$.
S	29·46	29·78	4·000	29·99
Sb ...	56·06	56·65	2·009	56·95
Fe ...	13·43	13·57	1·049	13·06
Mn ...	trace	—	—	—
Insol. ...	0·33	—	—	—
	99·28	100·00		100·00

The following table shows a remarkable difference between the specific gravity of berthierite from Kisbánya and Felsőbánya and that from some other localities; the two values being about 4·6 and 4·0 respectively, although the chemical composition is essentially the same in each. The higher value [near that of stibnite 4·5 – 4·6] is no doubt the correct one. Nos. 3 and 5 are old determinations, and in no. 4, 19·76 and 23·31 % of quartz were deducted from the results of the analysis for which no allowance was made in the specific gravity.

	1.	2.	3.	4.		5.
Sp. gr. ...	4·652	4·622	4·043	3·89—3·91		4·062
S	29·46	29·28	29·27	29·18	30·20	29·12
Sb ...	56·06	55·96	57·88	57·44	55·40	56·61
Fe ...	13·43	12·61	12·85	13·38	14·40	10·09
Mn ...	trace	0·31	—	—	—	3·56
Insol. ...	0·33	0·05	—	—	—	—
	99·28	99·45	100·00	100·00	100·00	99·38

1. Kisbánya. Analyst, L. Zombory, 1934.
2. Felsőbánya. Analyst, L. Loczka, 1928 (J. Krenner, loc. cit.). Also Zn 0·24, Cu 0·06, Pb 0·94, As trace.
3. Aranyidka. Analyst, J. Pettko, 1847 (A. Löwe, loc. cit.).
4. Bohutin, near Příbram, Bohemia. Analyst, R. Vambera, 1898 (A. Hofmann, Sitz.-Ber. böhm. Gesell. Wiss., 1898, vol. II for 1897, no. 49). Also Pb trace.
5. San Antonio, Lower California, Mexico. Analyst, — Freese, 1866 (C. F. Rammelsberg, Zeits. Deutsch. Geol. Gesell., 1866, vol. 18, p. 244; Handbuch d. Mineralchemie, 2nd edit., 1875, part 2, p. 86).